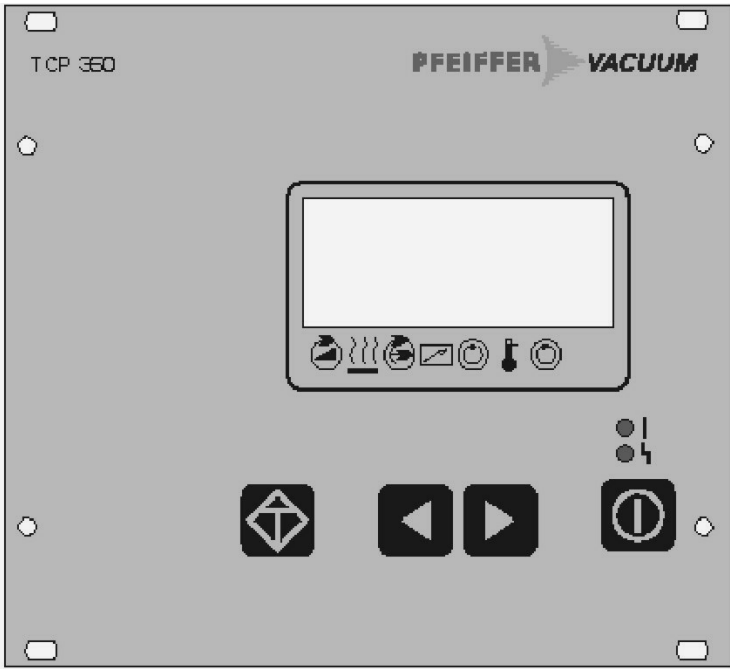
Betriebsanleitung • Operating Instructions

Electronic Drive Unit



TCP 350

PT 0092 BE/C (0302)

PFEIFFER VACUUM

Contents

We reserve the right to make alterations.

Please note: Up-to-date operating instructions are also available from www.pfeiffer-vacuum.de, "Infoservice".

1. Important Notes for Your Safety

- ☞ Read and follow up all information given in these instructions.
- ☞ Inform yourself about:
  - – Hazards caused by the unit.
  - – Hazards caused by your system.
- ☞ Note the safety and accident prevention regulations.
- ☞ Regularly check compliance with all safety measures.
- ☞ Install the TCP 350 while maintaining the specified ambient conditions.
- ☞ System of protection is IP 20. The unit is protected against being penetrated by foreign objects exceeding a diameter of 12 mm. There is no protection against entering water, for this reason the unit must be installed in a suitable case (see Chapter 3 – Installation).
- ☞ Never convert or modify the unit on your own.
- ☞ During operation or in the event of a fault condition never disconnect any cables connected at the TCP.
- ☞ After a mains power failure and after mains power returns, the pump will start up automatically.
- ☞ Make sure that the insulation of the cables is undamaged.
- ☞ Never remove the cover of the casing while mains power is applied or while the pump is running.
- ☞ Note the voltage specifications when connecting the cables to the various plugs.
- ☞ Make sure that the cables are laid correctly so that the possibility of damaging the cables can be excluded. Never lay cables over sharp edges or across hot surfaces.
- ☞ Always operate the unit within the specified voltage range (see also Chapter 3.4).
- ☞ The unit must not be operated as a bench top unit without the covers in place.
- ☞ Via the mains connection a reliable connection to the ground wire (PE) must be ensured (German Protection Class 1).
- ☞ Mains connectors or mains switches must be easy accessible for any switch off processes.
- ☞ In case of “Emergency Off” the mains must be switched off. For special demands please contact Pfeiffer Vacuum Service.
- ☞ Protect the unit against being thermally overloaded.
- ☞ Never disconnect any connectors at the unit or at the turbomolecular pump while running or before the pump has stopped completely.
- ☞ When returning the unit, note our shipping information first (Chapter 9).

Piktogramm-Definition

Risk of suffering an electric shock.

Risk of suffering injury.

Risk of damaging the unit or the system.

Important information on the product, its usage or part of the documentation which requires particular attention.

2. Getting to Know Your TCP 350

2.1. For Your Assistance

Icons used
The following icons are used throughout all the figures of this document:

Ⓥ Fore vakuumflange

Ⓕ Vent connection

Electrical connection

Air cooling

Item numbers
The item numbers are the same for all accessory items in all figures.

Work instructions in the text
➡ Here you need to do something.

Abbreviations used

TMP	Turbomolecular Pump
TPH	Turbomolekular Pump for High Vacuum
TPU	Turbomolekular Pump for Ultra High Vacuum
TCP	Controller Turbomolecular Pump (Electronic Drive Unit)

Text explanations (example)
[P:701**]** = selectable parameter number
«**Param. Set**» = Parameter designation

2.2. Description of the Product

The TCP 350 electronic drive unit serves the purpose of driving and monitoring PFEIFFER turbomolecular pumps.

Delivery Scope

The following items are delivered:
– TCP 350
– Mating plug for the “Remote” socket

The TCP electronic drive unit is composed of the following functional units:
– Electronic drive system monitoring and control
– Illuminated LC display providing information on the operational status of the turbomolecular pump
– Parameter selection and setup
– RS 232/485 serial interface
– Remote control

Connection Options

The TCP 350 electronic drive unit offers the following connection options:
– Remote control (“Remote”)
– Master computer via RS 485/RS 232 serial interface
– Turbomolecular pump (“Pump”)
– Gauge head (“Gauge”)

Proper Usage Intended by Design

– The TCP 350 electronic drive unit must be used only in connection with turbomolecular pumps TMH/TMU 071/261/521 from PFEIFFER.
– The operating unit consisting of TCP and turbomolecular pump must be operated in connection with a backing pump.
– Compliance with installation, commissioning, operating and maintenance instructions must be ensured.

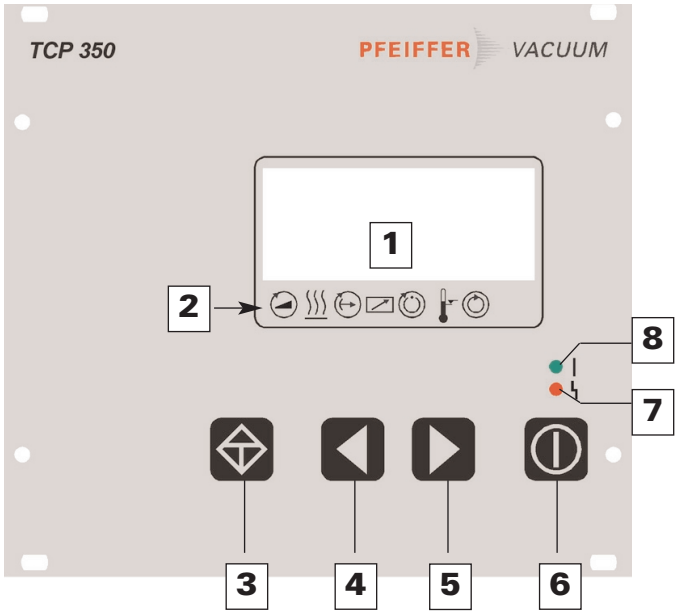
Improper Usage

Any of the following is considered as improper usage:
– The use for purposes, other than those detailed above, in particular:
  – connection of the drive unit to pumps and instrumentation not specified for being operated by the drive unit;
  – connection to instrumentation with components carrying voltages which are not touch protected.

Any improper usage will void your liability and warranty rights.

2.3. Description of the Front Pane

All controls and display components are located on the front panel.

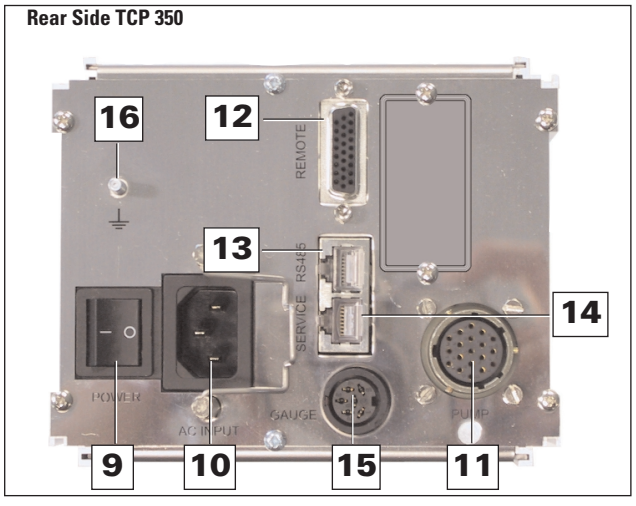


1 LC display, illuminated
2 Status display
3 Key “Acknowledge”
4 Parameter selection key “go back”
5 Parameter selection key “advance”
6 Key “Pump system ON/OFF”
7 Red light emitting diode for error status
8 Green light emitting diode for operational status

2.4. Description of the Rear Side

Located on the rear are the connectors for the various connections as well as the mains switch.

Rear Side TCP 350

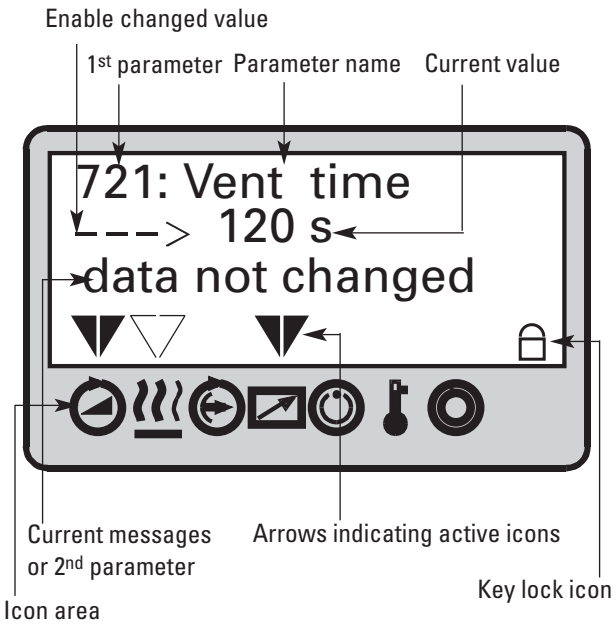


9 Mains switch (POWER)
10 Mains connection (90-135/185-265 V AC), (AC INPUT)
11 Connector Turbopump (PUMP)
12 Connector remote control (REMOTE)
13 Connector RS 485 interface
14 Connector RS 232 service interface (SERVICE)
15 Connector gauge head (GAUGE)
16 Ground terminal PE

2.5. General Description of the Unit

The electronics of the TCP 350 electronic drive unit provides for a number of monitoring and control options for turbomolecular pumps and for the pumping process. The drive unit may be operated either through keyboard, interface or remote control unit.

The LC Display



Through the LC display, various operating modes can be displayed. The way in which the vacuum components operate is controlled through parameters, i.e. through certain combinations of numbers to which a function has been assigned. The parameters which may be selected are detailed in the parameter overviews of Chapter 5.2 and 5.3.

Parameter Sets

The parameters can be invoked from two different parameter sets (see also the descriptions in Chapter 5.1):
– Basic parameter set
– Expanded parameter set

Parameter Types

There are three types of parameters:
– Adjustment commands
– Status queries
– Setpoint presets

The factory default settings may either be retained, or under “Adjustment commands” and “Setpoint presets” the user may enter his own settings. When wanting to enter presets or change operating modes, the information given in Chapter 6 “Operation” must be noted.

Operation via remote control is detailed in Chapter 6.12. Operation involving the interface is detailed in Chapter 6.14.

3. Installation

3.1. Before Installing the Unit

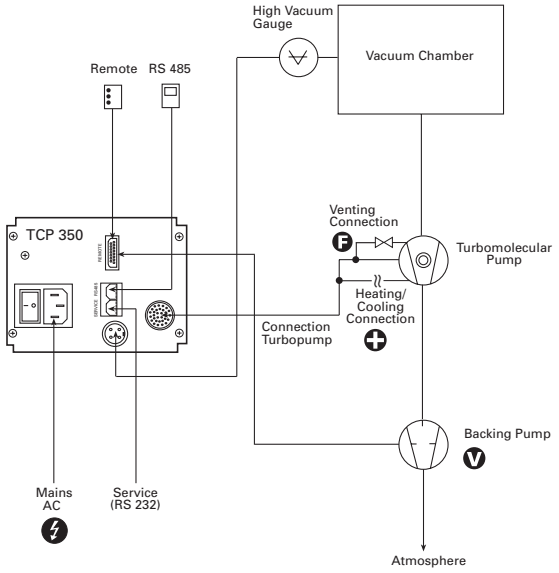
Never convert or modify the unit on your own. The unit must be installed in a suitable case in line with the ambient conditions encountered (see Chapter 10 “Specifications”).

Electrical wiring diagram: see Chapter 11.

➡ During all installation work make sure that the mains plug has been disconnected and that it is not reconnected inadvertently.

3.2. Connection Diagram

Connection diagram



➡ Install the TCP 350 unit while maintaining the following ambient conditions:

Location:	weather protected (indoor).
Temperature:	+5 °C to +40 °C.
Rel. humidity of the air:	80 % at T ≤ 31 °C up to 50% at T ≤ 40 °C
Atmospheric pressure:	77 kPa to 106 kPa
Installation height:	2000 m max.
Pollution level:	2
Excess voltage class:	II
Connection voltage:	115 VAC (+ 15/-20)% 230 VAC (+ 15/-20)%

3.3. Rack Mounting

To install the unit in a 19-in. rack enclosure, insert the unit as required into a 19-in. 3 HU mounting frame and then affix the mounting frame.

The ambient temperature within the rack must not exceed +40 °C.

The unit must be installed in an enclosure which complies with the required type of protection in each case.

Cooling/Air Circulation
The drive electronics of the TCP 350 generates heat at an amount equivalent to 80 W. To dissipate this heat, you must ensure that air can circulate freely around the unit.

3.4. Mains Connection

– The unit has been designed in accordance with German protection class 1 regulations and for this reason must always be connected to protective ground.
– The mains connection must be provided in accordance with local regulations.
– Mains connectors or mains switches must be easy accessible for any switch off processes.

Risk of suffering an electric shock.

The mains voltage applied to the AC INPUT may range between 90 V to 135 V and 185 V to 265 V. It is not necessary to set the mains voltage on the TCP unit. It occures automatically.

➡ Plug the mains cord (see Accessories) into the socket marked “AC INPUT”
➡ Provide the mains connection.

Emergency Off

Integrate the TCP 350 in an emergency off safety circuit when it is used in a vacuum system. The emergency cutout must interrupt the TCP 350 supply voltage in case of triggering.

For special demands please contact Pfeiffer Vacuum Service.

3.5. Connecting the Turbo Pump

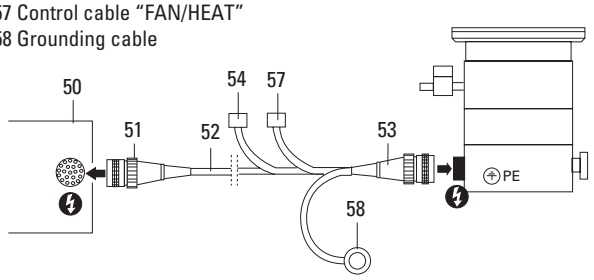
At the open electrical connection you must expect voltages up to 50 V rms while the pump is still running down.
Risk of suffering an electric shock when touching the contacts.

- ➡ Connect the turbopump using the connecting cable (52) to the socket marked PUMP on the TCP 350.
- ➡ Fix grounding cable (PE; 58) with enclosed screw M4x8 to the grounding connection of the turbopump.
- ➡ Lock the bayonet catch (51, 53) after plugging in.

To connect the pump only use connecting cables from PFEIFFER.

Connecting the turbopump

50 TCP 350 electronic drive unit
51 Bayonet plug ‡ TCP 350
52 Connecting cable TMP-TCP
53 Bayonet plug ‡ Turbopump
54 Control cable “VENT”
57 Control cable “FAN/HEAT”
58 Grounding cable



Disconnect the connector at the drive electronics only after the pump has stopped completely and after the unit has been disconnected from the mains power.

3.6. Connecting the Vent Valve

The vent valve (accessory) is used to vent the pump when shutting the pump down or in the event of a power failure. The vent mode is selectable through the front panel controls or the RS 485 interface.

- ➡ Install the vent valve at the turbopump in accordance with the operating instructions (see “Supplementary Information, Chapter 13”).
- ➡ Connect the control cable of the vent valve by means of an adapter to the control cable “Vent” 54 of the pump’s cable (adapter is enclosed with the pump’s cable).

3.7. Connecting the Air Cooling Unit

The air cooling unit is used to cool the turbopump at ambient temperatures below 35 °C.

- ➡ Install the air cooling unit at the turbopump in accordance with the operating instructions (see “Supplementary Information, Chapter 13”).
- ➡ Connect the control cable of the air cooling unit by means of the adapter to the control cable “FAN/HEAT” (57) of the pump’s cable (adapter is enclosed with the pump’s cable).

3.8. Connecting the Housing Heater

In order to faster attain the base pressure, turbopump and vacuum chamber may be baked out. The heating duration will depend on the contamination level and the required base pressure. Heating should last at least 4 hours.

When using a casing heater, the turbopump must be cooled with water.

- ➡ Install the casing heater at the turbopump in accordance with the operating instructions (see “Supplementary Information, Chapter 13”).
- ➡ Connect the control cable from the relay box by means of an adapter to the control cable “FAN/HEAT” (57) of the pump’s cable (adapter is enclosed with the pump’s cable).
- ➡ Connect the relay box for the casing heater to the mains power.

3.9. Connecting the Backing Pump

A backing pump can be driven by means of a backing pump relay box via the TCP 350.

- ➡ Install backing pump and backing pump relay box at the turbopump in accordance with the operating instructions (see “Supplementary Information, Chapter 13”).
- ➡ Connect the control cable of the relay box in accordance with the connecting diagram (Chapter 11) to the “REMOTE” connector (pin 11 / pin 26).
- ➡ Connect the backing pump relay box to the mains power.

3.10. Connecting the Remote Control

The TCP 350 or the entire pump system may be remotely controlled through the REMOTE connector. Before connecting the remote control, you must first select the remote control mode (see Chapter 6.12).

- ➡ Connect the remote control depending on the required functions to the mating plug REMOTE in accordance with the connection diagram given in Chapter 11.

Pinout for the Remote Connector

Pin	Designation	Function	Type
1	+ 24 VDC	Reference voltage for all inputs and outputs (floating)	–
2	Vent enable	"Vent pump" enabled (after pre-selected vent mode)	Digital input (static signal)
3	Motor TMP "ON"	Switch turbopump drive on (is only switched on after the pump system has also been switched on).	Digital input (static signal)
4	Pumping station "ON"	Switch the pumping station on	Digital input (static signal)
5	Standby "ON"	Limit turbopump speed to 66% of max. speed. (adjustable via [P:717])	Digital input (static signal)
6	Heating "ON"	Housing heater is switched on after the trigger level has been exceeded.	Digital input (static signal)
7	Rotation speed preset 0-10 VDC	Preset rotation speed set-point for the turbopump in the range between 20 to 100% of the max. pumping speed.	Analog voltage input 2-10 VDC 0-2 V=f_{nom}
8	Switching output 1 (threshold)	Output high=24 VDC, if the trigger level has been exceeded.	Digital output (static signal) (I_{max} = 50 mA)
9	Switching output 2 (Error)	Output high=24 VDC, if no error is present.	Digital output (static signal) (I_{max} = 50 mA)
10	n.c.	Not used	
11	Backing pump output	Output high=24 VDC, when the pump system has been switched on.	Digital output (static signal)
12	$U_f/U_i/U_p$ - voltage output-	Output voltage 0-10 VDC proportional to frequency, current or power (can be parameterized).	Analog voltage output 0-10 VDC/ R_L > 10 kΩ
13	Error acknow-ledge (Reset)	Erasure of an error message	Digital input (pulse)
14	Remote priority "ON"	Remote functions take precedence over keyboard or RS 485.	Digital input (static signal)
15	Relay contact threshold	Pins 15 and 16 linked, if TMP exceeds threshold.	Relay contact U_{max} = 50 VDC
16	Relay contact threshold	Pins 16 and 17 linked, if TMP drops below threshold.	I_{max} = 1 A
17	Relay contact threshold		
18	Relay contact	Pins 18 and 19 linked, if no error	Relay contact U_{max} = 50 VDC
	error		
19	Relay contact		
	error	Pins 19 and 20 linked, if error occurs.	I_{max} = 1 A
20	Relay contact		
	error		
21	n.c.		
22	n.c.		
23	n.c.		
24	n.c.		
25	n.c.		
26	GND*	Reference ground for all inputs and outputs (floating)	

n.c. = not connected

3.11. Connecting the Gauge Head

One of the gauge heads listed below may be connected to the "GAUGE" connector.

Gauge Head	p_{min} [mbar]	p_{max} [mbar]
TPR 2xx (HVV)	5E-4	1E+3
IKR 2xx	2E-9	1E-2
PKR 2xx (HVV)	5E-9	1E+3
ACR261/CMR261	1E-1	1,1E3
ACR262/CMR262	1E-2	1,1E2
ACR263/CMR263	1E-3	1,1E1

Through **[P: 738]** the type of connected gauge head must be setup or selected.

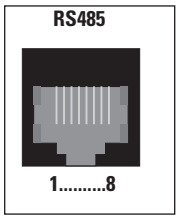
3.12. Connecting the RS 485 Interface

Interfacing is provided by means of an RJ45 plug (modular plug) at the socket "RS 485" on the rear of the unit.

Physical Link

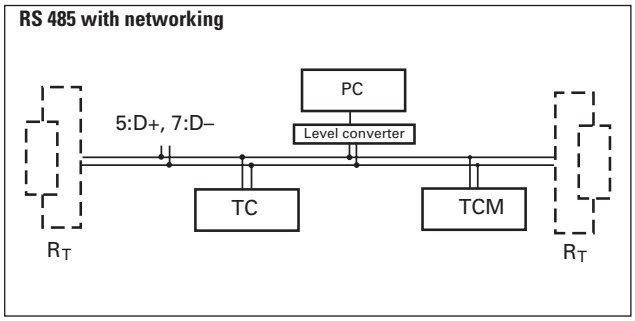
Designation	Value
Type of interface:	RS 485
Baud rate:	9600 baud
Data word length:	8 bit
Parity:	no parity
Start bits:	1
Stop bits:	1..2

"RS 485" pinout



PIN	Assignment
1	not connected
2	+24 V* DC (load current < 150 mA)
3	not connected
4	not connected
5	RS 485: D+ (DO / RI)
6	gnd*
7	RS 485: D- ($\overline{DO}$ / $\overline{RI}$)
8	not connected

A RS 485 bus is arranged as depicted in the figure below, for example. By means of standard modular connectors, cables and branch-offs the signals are looped through from one unit to the next.



Connection to a fixed bus system

➡ Connect all units with D+ (pin 5) and D- (pin7) to the bus.

The bus must be terminated at both ends with RT.

Networking of several units

➡ Loop the bus through with the aid of a tee piece.

The bus must be terminated at both ends with RT.

All units connected to the bus must be set to a different interface address [P:797].

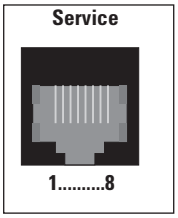
Only extra-low voltages may be connected to the RS 485 interface.

3.13. Connecting the RS 232 Interface

Interfacing is provided by means of an RJ45 plug (modular plug) at the socket "SERVICE" on the rear of the unit.

Designation	Value
Type of interface:	RS 232
Baud rate:	9600 baud
Data word length:	8 bit
Parity:	no parity
Start bits:	1
Stop bits:	1..2

Physical Link



"Service" pinout

Pin	Assignment
1	reserved[1)]
2	reserved[1)]
3	RS 232 RxD
4	RS 232 TxD
5	reserved[1)]
6	Gnd
7	reserved[1)]
8	reserved[1)]

[1)] **Caution!** No connections may be run to these pins. They are only used by PFEFFER Service!

4. Operating And Display Elements

4.1. Operating Elements

The four push-buttons on the front panel have the following functions:

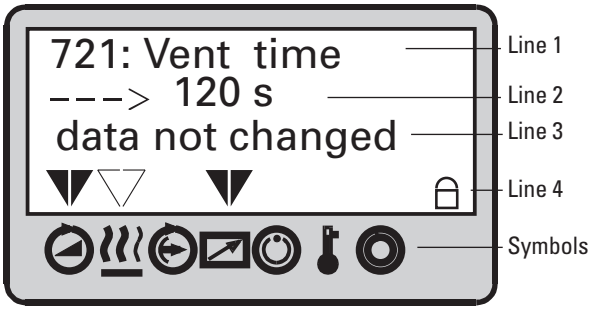
Push-Button	Application/Example		Explanation
			**Reset** (malfunction acknowledgement) acknowledges malfunctions (red LED illuminates)
		⇳309: Act rotspd ⇳310: TMP I-Mot	**Scroll Parameters Backwards** scrolls a parameter backwards
	——>	⇙50% ⇙ 49%	**Reduce Values** (arrow "——>" appears)
		⇲310: TMP I-Mot ⇲311: TMP Op hrs	**Scroll Parameters Forwards** scrolls a parameter forwards
	——>	49% ⇗ 50% ⇗ ...	**Increases Values** (arrow "——>" appears)
		001: Heating ☞ off	**Alters Values** (⇨data editing mode) access to a displayed value, if possible (arrow "——>" appears)
simultaneous-ly	——>	001: Heating off ✔	**Conforms a Value** (⇨parameter selecting mode) takes over altered value (arrow "——>" disappears)
		010: Pump stat. on ⇔ off	**Pumping Station ON/OFF** switches the pumping station ON or OFF, corresponding to Parameter 010: "Pump stat."

The following should also be noted:
-The data editing mode (arrow "——>" is displayed) is automatically exited under the following conditions, without taking over the possible altered value:

– if no push-button is depressed for approximately 10 seconds.
– an error occurs.

4.2. Display Elements

LC Display



The display of the functions is shown via a four line LC display. In normal operations a specific function is assigned to each line:

- **Line 1**: Number and name of the selected parameter (e.g. «**721: Vent time**»).
- **Line 2**: relevant value. In the data editing mode **[**P:795**]** an arrow (--->) is displayed left. The value can now be altered.
- **Line 3**: With two functions,
  Function 1: Actual messages which refer to operation and control appear (see table "Operating Messages (line 3)" on the next page.
  Function 2: An optional second parameter in the form «Parameter number»: «Value» is is displayed. The function of this line is set via «**725: Servicelin**»: The value «**795**»» allows actual messages to appear.

  Error messages/ warning messages overwrite the selected value of the parameter.

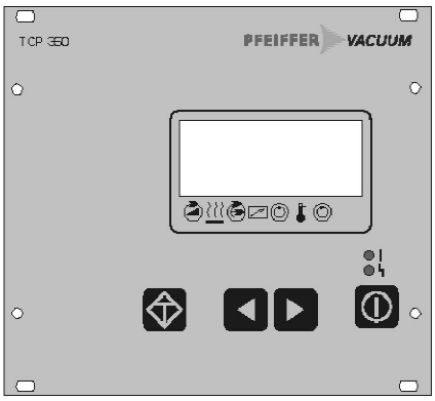
- **Line 4**: Arrows which point to the underlying symbols. These restore the unit status.

  Symbols "keyboard lock" and "battery box connected".

Symbol Definitions

Symbol	Meaning	Display	Explanation
	Pump	–	No
	accelerates	▼	YES
	Pre-selection housing-/ TMS-heating	–	OFF
		▽	Pre-selection heating ON
		▼	Heating ON
	Standby	–	OFF
		▼	ON
	Unit	–	NO
	remote controlled	▼	YES
	Rotation switchpoint attained	–	NO
		▼	YES
	Excess temperature	–	NO
		◥	Excess temperature TMP
		◥	Excess temperature Magnetic Bearing Elektronic
		▼	Excess temperature TMP and Magnetic Bearing Elektronic
	Final rotation speed attained	–	NO
		▼	YES
	Keypad lock	🔓	ON, operation locked via keys
	Battery box		Battery box connected. No statement with regard to the charge level of the battery.

4.3. Abbreviated Overview, Operating



Selecting Parameters

➡ Selecting parameters with push-button ◀ (backwards) or ▶ (forwards). Keeping the key depressed enables rapid scrolling.

Setting Parameters

➡ Select Parameter.

➡ Depress key-button ◀ and ▶ simultaneously till an arrow (--->) will appear in the second line from the top.

➡ With key-button ◀ reduce the value and with key-button ▶ increase the value.

· Depress key-button ◀ and ▶ simultaneously till the arrow (--->) disappears. The set values are now taken over.

Error acknowledgement

Depress key-button ◈.

Switching ON and OFF the pumping Station

Depress key-button ⏻.

4.4. Operating Examples

Switching on the electronic drive unit

➡ Switch on the unit on the rear side with switch “POWER”.

Switching on the pumping station

➡ Select «**794 : Param. Set**».
➡ Select «1».
➡ Check set values [P:7xx] and setting commands [P:0xx], change if necessary.
➡ Switch on the pumping station with key ⏻.

Casing heating ON/OFF

➡ Select «**794 : Param. Set**» and set to «1».
➡ Select «**001 : Heating**» and set to «1».
➡ Save adjustment.

Switching off the Turbo pump

➡ Bridge “REMOTE”, remove Pin 1/3.
➡ Select «**023 : Motor TMP**».
➡ Select «OFF», or «ON».
➡ Save adjustment.

Switching off the pumping station

➡ Depress key-button ⏻ on the front panel.

Details see chapter 6 “Operation”.

Illuminated Displays

The red LEDs (error status) and green LEDs (operations status) on the front panel can assume the following conditions:

	Red LED	**Green LED**
Illuminates:	Collective error message	Mains ON, pumping station ON [P:010]
Flashes short: (1/12s active)	Warning	Mains pack ON, pumping station OFF [P:010]
Blinks: (1/2s active)	Turbopump vibration	Mains power failure

Operations Messages (Line 3)

Independent to the adjustments at «**795: Servicelin**»:

Meldung	**Bedeutung**
** Error Exxx **	Error xxx has occured
* Warning Fxxx *	Warning xxx has occured

5. Parameters

5.1. General

All function relevant sizes of the magnetic bearing controller are structured in the form of parameters. Each parameter has a number and a clear text designation (e.g. « **026: OpMode TMP**»). There are three different parameter types:

Type of Parameter	**Function**
Setting commands	Activating/de-activating a controlling function
Status requests	Parameter status/value request (readable only)
Set values	numerical modifying of a value

The total of the available parameters represents a parameter set.

To adapt this parameter to the individual requirements of the user the TCP 350 provides three parameter sets which differ from each other in the number of parameters and their sorting. The respective parameter set can be selected via the parameter «**794: Param. set**».

Parameter set	**Notice**	**Setting «794: Param. set»**
Basic parameter set	Only basic function parameters sorted by number	**0**
Extended parameter set	Complete parameter set sorted by number	**1**
Parameter set, operational orientated	Complete parameter set sorted according to application criteria	**2**

5.2. Parameter Overview, numerical

Setting Commands (readable and writable)

#	Anzeige		Name, Beschreibung	min	max	fact. set.	RS 485[1]	Data typ[2]
001	**Heating**	💾	Pre-selection, heating. 0=OFF; 1=ON	OFF	ON	OFF[3]	R/W	0
002	**Standby**	💾	Stand-by ON/OFF	OFF	ON	OFF[3]	R/W	0
004	RUTime ctr	💾	Run-up time monitoring ON/OFF	OFF	ON	ON	R/W	0
008	Keys lockd	🔒	Keyboard interlock			–	R/W	0
009*			Error acknowledgement			–	W	0
010	Pump stat	💾	Pumping station ON/OFF	OFF	ON	OFF[3]	R/W	0
012	Vent enab	💾	Venting enable Turbopump ON/OFF	OFF	ON	OFF[3]	R/W	0
019	Conf. OUT2	💾	Config. K2 0= open if mains OFF or failure, 1=dto. or warnings 2=open if mains OFF, turbo drive OFF or failure	OFF	ON	OFF	R/W	7
023	Motor TMP	💾	Motor Turbopump ON/OFF	OFF	ON	ON[3]	R/W	0
025	OpMode BkP	💾	Operations mode backing pump, 0=non-stop; 1=intermittent	0	1	0	R/W	7
026	OpMode TMP	💾	Operations mode TMP 0=final rotation speed operations; 1=rotation speed setting mode	0	1	0[3]	R/W	7
027	Gas mode	💾	Gas mode 0=heavy inert gases; 1=other gases	0	1	0	R/W	7
028	Opmode rem	💾	Remote operations mode 0=standard operations, 1=remote priority	0	1	0	R/W	7
030	Vent mode	💾	Venting mode 0=automatic venting ; 1=do not vent; 2=venting "ON"	0	2	0	R/W	7
055	Conf A01	💾	Configuration analog output 1; 0=rot.speed, 1=power, 2=Current	0	2	0	R/W	7

Status requests (only readable)

#	Display		Name, Description	min	max	fact. set.	RS 485[1]	Data typ[2]
300*	↗		Unit remote controlled			–	R	0
301	Oil defic		Oil deficiency turbopump	–	–	–	R	0
302*	◎		Rotation switch point attained			–	R	0
303	**Error code**		Actual error code „no Err", „Errxxx" oder „Wrnxxx"			–	R	4
304*	🌡		Over temperature electronic drive unit			–	R	0
305*	🌡		Over temperature turbopump			–	R	0
306*	◎		Set rotation speed attained			–	R	0
307*	◔		Turbopump accelerates			–	R	0
308	**Set rotspd**		Set rotation speed TMP in Hz	0	2000	–	R	1
309	**Act rotspd**		Actual rotation speed TMP in Hz	0	2000	–	R	1
310	**TMP I-Mot**		Motor current TMP in A	0.00	10.00	–	R	2
311	**TMP Op hrs**	💾	Operating hours TMP in h	0	99999	–	R	1
312	PCS Softw		Software version electronic drive unit	V 0.0	V 25.4	–	R	4
313	TMP DClink		Motor voltage TMP in V	0.0	127.5	–	R	2
314	Drv Op hrs	💾	Operating hours electronic drive unit	0	99999	–	.R	1
315	**TMP finspd**		Final rotation speed TMP in Hz	0	2000	–	R	1
316	TMP power		Motor power TMP in W	0.0	1000.0	–	R	1
319	Cycl count	💾	Cycle counter	0	99999	–	R	1
335	Heat type	💾	Heating typ 0=convent. heating, 1=TMS, 2=cooling, 255 no heating	0	2	–	R	7
340	Pressure		Actual pressure value in mbar	1E-12	1E3	–	R	3
349	Drv Name		Unit type electronic drive unit			TCP 350	R	4
352	Drv Softw.		Software motor control					
360	Past Err1	💾	Error storage, Position 1 (last error occuring)			–	R	4
361	Past Err2	💾	Error storage, Position 2			–	R	4
362	Past Err3	💾	Error storage, Position 3			–	R	4
363	Past Err4	💾	Error storage, Position 4			–	R	4
364	Past Err5	💾	Error storage, Position 5			–	R	4
365	Past Err6	💾	Error storage, Position 6			–	R	4
366	Past Err7	💾	Error storage, Position 7			–	R	4
367	Past Err8	💾	Error storage, Position 8			–	R	4
368	Past Err9	💾	Error storage, Position 9			–	R	4
369	Past Err10	💾	Error storage, Position 10			–	R	4

Set values (readable and writable)

#	Display		Name, description	min	max	fact. set.	RS 485	Data typ[2]
700	**TMP RUTime**	💾	maximum run-up time in mins	1	120	8	R/W	1
701	**Switch pnt**	💾	Rotation speed switchpoint in %	50	97	80	R/W	1
707	TMProt set	💾	Rotation speed set value in rotation speed setting operations in %	20.0	100.0	50.0[3]	R/W	2
710	BKP off	💾	P_{min} for Interval operations backing pumps [W]	0	1000	0	R/W	1
711	BKP on	💾	P_{max} for Interval operations backing pumps [W]	0	1000	0	R/W	1
717	Stbyrotset	💾	Drehzahlvorgabe im Standbybetrieb in %	20	100	66,7	R/W	2
720	Vent frequ	💾	Venting frequency as a % of the final rotation speed of the TMP	40	98	50	R/W	7
721	Vent time	💾	Venting time in s	6	3600	3600	R/W	1
738	Gaugetype		Vacuum pressure gauge type			–	R/W	4
777	**PumpRotMax**		Max. rotation speed	0	2000	777	R/W	1
794	**Param. set**	💾	Parameter set 0 = basic parameter set; 1 = extended parameter set	0	1	0	R/W	7
795	Servicelin	💾	Contains the service line 795=messages; ≠795 = # of the 2. param. set			309	R/W	7
797	Address	💾	Unit address	1	255	1	R/W	1

A number in bold type is a basic parameter set, e.g. "**700 TMP RUTime**".
💾 = Parameter setting is saved internal and preserves the value if mains is switched off.
1) R = Parameter readable via interface /W = parameter writeable via interface.
2) See Interface instruction "Pfeiffer Protocol to RS 232 and 485" / PM 800 488 BN
3) Function can only be affected via remote plug
* Parameters are not shown in the LC display but displayed by symbols (line 4) or operable by the keys.

5.3. Parameter overview, operation oriented

#	Display	Name, Description	min	max	fact. set.	RS 485	Sect.
Run up time and switch point							
004	RUTime ctr	Run-up time monitoring ON/OFF	OFF	ON	ON	●	-
700	TMP RUTime	Maximum run-up time in mins	1	120	8	●	6.2.,6.4.
701	Switch pnt	Switchpoint in %	50	97	80	●	6.4.,6.11.
General operating information							
301	Oil defic	Oil deficiency Turbopumpe	–	–	–	●	
315	TMP finspd	Final rotation speed TMP in Hz			–	●	6.2.,6.5.
310	TMP I-Mot	TMP motor current in A			–	●	6.2.
313	TMP DClink	TMP motor voltage in V			–	●	-
316	TMP power	TMP motor power in W			–	●	-
311	TMP Op hrs	Operating hours TMP in h			–	●	-
319	Cycl count	Cycle counter	–	–	–	●	-
349	Drv Name	Unit type electronic drive unit	–	–	TCP 350	●	-
352	DrvSoftware	Software motor control			TCP 350	●	-
Operating adjustment turbopump							
002	Standby	Stand-by ON/OFF	OFF	ON	OFF[3)]	●	6.3.
010	Pump stat	Pumping station ON/OFF	OFF	ON	OFF[3)]	●	-
023	Motor TMP	Motor turbopump ON/OFF	OFF	ON	ON[3)]	●	6.8.
026	OpMode TMP	Operations mode TMP 0 = final rotation speed; 1=rotation speed setting mode	0	1	0	●	6.9.
027	gas mode	Operations mode 0=heavy inert gases; 1=other gases	0	1	0	●	6.7.
055	ConfA01	Configuration analog output 0=rot. speed, 1=current, 2=power	0	2	0	●	
308	Set rotspd	Set rotation speed TMP in Hz	0	1000	–	●	-
309	Act rotspd	Actual rotation speed TMP in Hz	0	1000	–	●	-
707	TMProt set	Preset rot. speed in rotation speed setting mode in %	20.0	100.0	50.0[3)]	●	6.5.,6.9.
717	Stbyrotset	Preset rot. speed in stand-by mode in %	20	100	66	●	6.3.
777	PumpRotMax	Max. rotation speed	0	2000	0	●	6.2.
Heating/cooling turbopump							
001	Heating	Pre-selection, heating. ON/OFF	0	1	0[3)]	●	6.4.,6.5.
335	Heat type	Heat type 0=convent. Heizung, 1=TMS, 2=cooling, 255=no heating	0	255	–	●	6.6.,6,7.
Vent valve controlling turbopump							
012	Vent enab	Venting release turbopump ON/OFF	OFF	ON	ON	●	6.14.
030	Vent mode	Venting mode 0=automatic venting ; 1=do not vent; 2=venting "On"	0	2	0(*)	●	6.14.
720	Vent frequ	Venting frequency as a % of the final rotation speed of the TMP	40	98	50	●	6.5.,6.14.
721	Vent time	Venting time in seconds	6	3600	3600	●	6.14.
Pumping station control							
025	OpMode BkP	Operations mode backing pump, 0=non-stop operations; 1=intermittent operations	0	1	0	●	6.10.
710	BKP off	P_{min} for Interval operations [W]	0	1000	0	●	6.10.
711	BKP on	P_{max} for Interval operations [W]	0	1000	0	●	6.10.
738	Gaugetype	Vacuum pressure gauge type			–	●	6.10.
340	Pressure	Actual pressure value in mbar	1E-12	1E3	–	●	6.10.
Others							
019	Conf. OUT2	Config. K2 0= open if mains OFF or failure, 1=dto. or warnings 2=open if mains OFF, turbo drive OFF or failure	0	2	0	●	3.
028	OpMode Rem	Remote Operations mode 0=Standard operations, 1=Latch (Pin 14 "Remote" set to 1)	0	1	0	●	6.13.
303	Error code	Actual error code „no Err", „Errxxx" oder „Wrnxxx"			–	●	4.4.
312	Drv Softw	Software version electronic drive unit			–	●	8.0.
794	Param. set	Parameter set 0=basic parameter set; 1=expanded parameter set;					
795	Servicelin	Contains the service line 795=messages; ≠795=# of the second parameter set			795	●	4.2.
797	Address	Unit address	1	255	1	●	6.15.
Table of failures							
360	Past Err1	Error storage, Position 1 (last visible failure)			–	●	7.
361	Past Err2	Error storage, Position 2			–	●	7.
362	Past Err3	Error storage, Position 3			–	●	7.
363	Past Err4	Error storage, Position 4			–	●	7.
364	Past Err5	Error storage, Position 5			–	●	7.
365	Past Err6	Error storage, Position 6			–	●	7.
366	Past Err7	Error storage, Position 7			–	●	7.
367	Past Err8	Error storage, Position 8			–	●	7.
368	Past Err9	Error storage, Position 9			–	●	7.
369	Past Err10	Error storage, Position 10			–	●	7.

[3)] Function can only be affected via remote plug (X16)

● Function can be called by RS 485

6. Operations

6.1. Switching On The Unit

➡ Switch on the TCP 350 using the "Power" switch on the rear side of the unit.

Self test

The TCP 350 performs a self-test. Once the self-test is complete, the unit is ready for operation.

6.2. Setting the max. Pumping Rotation Speed

Before putting the turbo pump into operation, you must set the maximum pumping rotation speed **[P:777].** The turbo pump will not start unless this value is pre-set. The error message **E777** is displayed. Please refer to the relevant turbo pump operating instructions to ascertain the maximum pumping rotation speed.

➡ Select «**777 : PumpRotMax»** and enter the maximum pumping rotation speed.

6.3. Switching On the Pumping Station

Before the pumping station is switched on, the reference value inputs and control commands (see Chapter 5) must be checked to ensure their suitability for the selected pump and application in question, and changed if necessary.

➡ Select «**794 : Param. Set»** and set to «**1**».
➡ Check **[**P:7xx**]** reference value inputs and **[**P:0xx**]** control commands.

➡ Switch on the pumping station using the ⏻ key on the TCP. Alternatively, switch on using the remote control or the serial interface.

The turbo pump begins to rotate. The rotation speed switch point **[**P:701**]** must be reached within the pre-set run-up time **[**P:700**]**. If an error code is displayed, see the error code table in Chapter 7.

Acknowledge the error with the ◈ key to reset the run-up time to the starting value.

Turbo Pump Normal Operation

Once the final rotation speed **[**P:315**]** has been reached, the motor current **[**P:310**]** sets itself to a particular value, depending on the gas throughput and fore-vacuum pressure.

6.4. Stand-by On/Off

➡ Select «**[P:002] Standby**».
➡ Select «**OFF**» or «**On**».

The factory setting for "Standby mode" is the turbo pump operating at 66.7% of its final rotation speed. This value can be changed.

➡ Select **[**P:717**]** «Stbyrotset».
➡ Set the standby speed within the range 20-100%.

Standby is recommended during stoppages. This function may also be activated via remote control or using the serial interface.

Standby mode is not possible in rotation speed setting mode (see item 6.8.).

Pumps with integral lubricant pump are initially accelerated to 60% of their nominal rotation speed in standby mode, even if the set standby speed is <60% x f_{nom}.

At operations below 50% x f_{nom} pump shut-down due to lubricant deficiency is possible.

6.5. Housing Heater ON/OFF

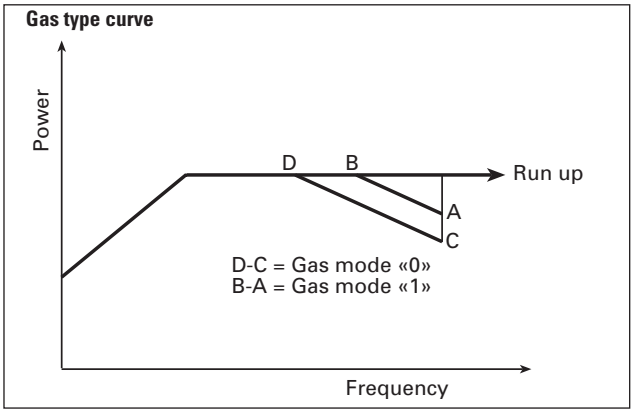
To activate the housing heater
➡ Select «**001 : Heating**» and set to «**1**».

The housing heater is switched on and off as a function of the rotation speed switch point **[**P:701**]**. The rotation speed dipping below the switch point causes the heater to switch off. The operating status of the housing heater can be ascertained by means of a symbol on the LCD (see item 4.2.).

The "Housing heater" function can also be implemented using the interface or the remote control.

6.6. Operation Dependent On Gas Type

In order to protect the rotor from overheating, the maximum capacity of some turbo pumps is limited to the nominal rotation speed. On the other hand, if the pre-selected rotation speed is lower, more power can generally be made available. This frequency/power curve depends upon the type of gas employed.



Selecting the type of gas

➡ Select «**794 : Param. Set**» and set to «**1**».
➡ Select «**027 : gas mode**».
➡ Select «**0**» for heavy inert gases (e.g. argon), «**1**» for other gases.

In case of adjusting a wrong gas type damaging of the pump can take place.

If the gas-dependent maximum capacity is exceeded, the rotation speed is decreased until equilibrium between the permitted capacity and gas friction is achieved. In order to prevent fluctuations in rotation speed, we recommend setting the frequency in rotation speed setting mode to the equilibrium level or somewhat lower (see item 6.8.).

The capacity values A, B, C and D are specified in the technical data of the pump operating instructions.

6.7. Turbopump ON/OFF

The turbo pump can be switched on and off separately whilst the pumping station is in operation.

➡ Select «**023 : Motor TMP**».
➡ Select «**OFF**», or «**ON**».

6.8. Rotation Speed Setting Mode

Select rotation speed setting mode when you wish to reduce the volume flow rate of the turbo pump. The pressure ratio of the pump falls exponentially with the rotation speed.

Speed preset in rotation speed setting mode

➡ Call **[**P:794**]** «Param set», select «**1**».
➡ Select **[**P:707**]** «TMProt set».
➡ Adjust the speed within the range 20-100%.

Operating mode of turbo pump

➡ Call **[**P:026**]** «OpMode TMP».
➡ Select <1> for rotation speed setting mode.

Standby mode is ineffective in rotation speed setting mode. Rotation speed setting mode can also be set by means of the remote control or the serial interface.

At operations below 50% x f_{nom} pump shutdown due to lubricant deficiency is possible.

Turbo pumps with integral lubricant pump are initially accelerated to 60% of their nominal rotation speed in standby mode, even if the set standby speed is <60% x f_{nom}.

6.9. Pressure Measurement

The pressure in the vacuum chamber is measured and displayed by the TCP 350 with the aid of an HV pressure gauge.

Basically an exactly pressure measurement is not possible by the DCU. This is especially indicated at linear working gauges in the lower pressure range. In case of doubt an intended measuring unit should be used.

The TCP 350 evaluates measurements from the following gauges:

Pressure Gauge	p_{min} [mbar]	p_{max} [mbar]
TPR 2xx	5E-4	1E+3
PKR 2xx	5E-9	1E+3
ACR 261/CMR 261/APR 250/260	1E-1	1E+3
ACR 262/CMR 262	1E-2	1E+2
ACR 263/CMR 263	1E-3	1E+1
CMR 264	1E-4	1E0

Requesting the gauge type

➡ Call **[**P:794**]** «Param set», select «**1**».
➡ Select or enter **[**P:738**]** «gauge type».
➡ Read out the gauge type.

Requesting the pressure actual value

➡ Call **[**P:794**]** «Param set», select «**1**».
➡ Select **[**P:340**]** «Pressure».
➡ Read out the pressure actual value [mbar].

Depending on the type of the gauge connected, the following messages may be displayed:

Display (example)	appears if
«---- mbar»	no gauge tube connected.
«<5E-4mbar»	value is below measuring range (depending on type of gauge used).
«>1E3mbar»	value is above measuring range (depending on type of gauge tube used)
«6.3E-9mbar»	measured pressure value is valid
«TPR2xx»	TPR 250 gauge selected
«no Gaug»	no gauge tube selected

6.10. Backing Pump Operation

The modes "Continuous operation" or "Intermittent operation" can be selected, depending upon which backing pump has been selected and upon the type of vacuum application. Intermittent operation is utilized, for example, for increasing the service life of diaphragms in diaphragm vacuum pumps. The backing pump is switched on or off as a function of the rated input of the turbo pump.

Rotary vane pumps may not be operated in intermittent mode.

Backing pump in continuous operation

➡ Call **[**P:794**]** «Param set»; select «**1**».
➡ Call **[**P:025**]** «OpMode BkP»; select «**0**» for continuous operation.

Backing pump in intermittent operation

➡ Call **[**P:794**]** «Param set»; select «**1**».
➡ Call **[**P:025**]** «OpMode BkP»; select «**1**» for intermittent operation.

To operate a diaphragm backing pump a relay box with semiconductor relay must be used. The backing pump is switched on and off as a function of the rated input of the turbo pump.

The varying rated input of the turbo pump in no-load operation means that different pumps have different pressure switch points. In addition, the gas ballast device causes diaphragm pumps to have different final pressures. These influences render it impossible to find the ideal pressure switch point setting by means of the rated input. In order to make optimum use of intermittent mode nevertheless, pressure switching thresholds can be individually set. We recommend operation between 5 and 10 mbar.

A dosing valve is required to set the switching thresholds. A measuring tube is connected directly to the TCP 350.

Setting the switching thresholds

➡ Select **[**P:340**]** «Pressure».
➡ With the pumping station running, let air into the fore-vacuum line with the dosing valve until the fore-vacuum pressure rises to 10 bar.
➡ Select **[**P:316**]** «TMP power».
➡ Read off the rated input at 10 mbar.
➡ Select **[**P:711**]** «BKP Pon».
➡ Save the rated input read at 10 mbar as the upper switching threshold.
➡ Proceed in the same way for the lower switching threshold, but with 5 mbar as the pressure value.
➡ Select **[**P:710**]** «BKP Poff».
➡ Save the rated input read at 5 mbar as the lower switching threshold.

6.11. Switching Off the Pumping Station

➡ Press the ⏻ key on the front panel. Alternatively, switch off the pumping station using the remote control or the interface.

After the pumping station has been switched off, the rotation speed sinks to 0 Hz.

6.12. Remote control

The following functions can be switched using the remote control (also see table, item 3.10.):

- Heating "ON/OFF"
- Standby "ON/OFF"
- Pumping station "ON/OFF"
- Turbo pump "ON/OFF"
- Error acknowledgement
- Vent enable "ON/OFF"
- Remote priority "ON/OFF"

Remote control operating modes

There are three basic types of remote control operation, with remote control functions having different levels of priority:

Standard remote control

➡ Set «**028 : «OpMode rem**» to «**0**».

The individual functions that can be operated by remote control are activated via “SPC high level”*). Once activated, these individual functions cannot be changed via the interface or the keyboard. They can be operated using the interface or keyboard once they have been deactivated by means of the remote control.

*) SPS-High-Pegel: +13 V to +33 V
SPS-Low-Pegel -33 V to +7 V
Ri: 7 kΩ

Remote control priority "ON"

For certain applications, e.g. stored-program controllers, the remote control functions can be set to have priority.
at f=0Hz:

➡ Set «**028 : OpMode rem**» to «**1**».
➡ Produce a bridge from pin 1 to pin 14 “Remote”.
–> All set functions are switched off.
–> The remote control functions can only be set via “Remote”. The keyboard and interface are not active.
–> The set values are saved.

The functions:

- TMP motor ON
- Heating ON
- Standby ON
- Pumping station ON
- Error acknowledgement
- Enable venting

are activated by way of "SPC high level" and deactivated by "SPC low level". In rotation speed setting mode, the reference value input is effected exclusively via pin 7.

If pin 14 is set to “SPC low”:
–> Values set via the remote control are imported.

Remote control priority "OFF"

➡ Set «**028 : «OpMode rem**» to «**1**» at f=0 Hz.
–> All set functions are switched off.
➡ Set pin 14 to «SPC low».
–> Operation only possible via keyboard and interface (remote control not active).

–> Set values are saved.

If «**028.: Op Mode rem**» is reset to «**0**»:
–> Values set using the keyboard or the interface are imported. The values set to “SPC high” via the remote control are also imported.

6.13. Venting the Turbo Pump

Venting can only take place after the pumping station has been switched off.

The venting valve is closed when de-energized. In the event of a malfunction, venting may take place, depending on which venting mode was selected.

The extended parameter set is used to choose between three venting modes:

➡ Call [P:794] «Param set»; select «1».
➡ Call [P:012] «Vent enab» ; select «ON».
➡ Call [P:030] «Vent mode»; select «0», «1» oder «2».

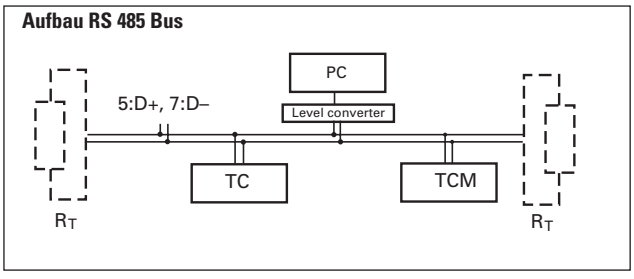
Venting mode «0»: Automatic venting
Automatic venting means that venting commences at a set frequency [P:720] for a set time [P:721] after the pumping station has been switched "OFF" or after power failure. The set time cannot be guaranteed in the event of power failure.

➡ Select [P:720] «Vent frequ».
➡ Set the venting frequency within the range «40-98%».
➡ Select [P:721] «Vent time».
➡ Set the venting time in seconds within the range «0» and «3600».
–> The venting valve is closed after “Power ON”.

Venting mode «1»: Venting OFF
–> The pump is not vented.

Venting mode «2»: Venting ON
–>Venting takes place after a delay of 6 s when “Pumping station OFF”, if a malfunction occurs or on power failure. During this delay time, any high vacuum valve present can be closed. In the event of power failure, venting will only last for as long as the pump energy can continue to feed the venting valve. The venting valve remains open after power “ON”. It closes when the pumping station is switched on.

6.14. Operation Using Interface RS 485



The group address of the TCP 350 is 988. Different interface addresses must be selected [P:797] for all the units connected to the bus.

Data communication is described in Operating Instructions PM 800 488 BN.

6.15. Emergency Generator Operation

If the power supply fails (Warning F007) whilst the turbo pump is in operation, the pump rotor acts as a generator and supplies power to the electronics. Power failure is also indicated by flashing green and red LED's on the front panel (50% ON; 50% OFF). At a particular rotation speed (depending on the pump), the pump energy will no longer suffice, at which point the TCP 350 will be shut down completely.

6.16. Configuring the Analog Output

An analog signal (0-10 VDC) can be tapped at the TCP 350, with the following information:

- Rotation speed of turbo pump
- Capacity
- Power input.

To this aim, the analog output must be configured in accordance with its function:
➡ Call [P:055] «Conf. AO1».
➡ Select function 0, 1 oder 2:
0 = Rotation speed signal, 0-10 VDC = 0-100% x f_{end}
1 = Capacity signal, 0-10 VDC = 0-100% x p_{max}
2 = Current signal, 0-10 VDC = 0-100% x I_{max}

For information about the values f_{final}, p_{max} and I_{max}, please refer to the operating instructions of the turbo pump you are using.

7. Error Messages and Warnings

7.1. General information

Error ("Errxxx" or "Error Exxx") always cause the turbo pump, fan, heater and backing pump to switch off.

➡ Once the error has been eliminated, press the key.
–> The unit is once more ready for operation.

7.2. Errors During Operation

Errors and warnings occurring during operation are always indicated on the LCD - regardless of the function of the service line - and can additionally be polled by means of the parameter [P:303] «Error code».
Further, the parameters 360 to 369 contain ten past errors.

Error	Meaning	Troubleshooting
E001	Excess rotation speed of TMP	- Inform PFEIFFER-Service
E006	Run-up time error Pump rotation speed drops below switch point after run-up time.	- Set run-up time correctly - Open fore-vacuum valve - Lower fore-vacuum pressure - Eliminate leak
E007[2)]	Insufficient lubricant	- Check lubricant level - Ascertain status of lubricant sensor via [P:301] - Inform PFEIFFER-Service
E015	Composite error in TCP controller	- Reset controller by power On/Off with pump stationary (f=0Hz) - Inform PFEIFFER Service if necessary
E021 **E621**	Incorrect pump characteristic impedance	- Inform PFEIFFER Service
E037	Error in motor end stage or drive circuit	- Inform PFEIFFER Service
E098	Error in internal communication	- Inform PFEIFFER Service
E037	Error in Motor endstage or controller	- Inform PFEIFFER Service if necessary
E040	Error expansion memory (RAM)	- Inform PFEIFFER-Service
E043	Incorrect saving of parameter values	- Inform PFEIFFER-Service
E044	Over temperature TCP	- Ambient temperature too high
E699	Drive error TCP	- Inform PFEIFFER-Service
E777	Parameter 777 not set to the final rotation speed of the connected turbopump	- Set parameter 777 (see operating instructions of the turbopump)
E913[1)]	Error during self-test or turbo pump run-up	- Error resets itself - Check pump idle running - Inform PFEIFFER Service if necessary

[1)] Error message is not indicated via switching output 2 (collective error message).
[2)] An error can be acknowledged max. 5 times.
S: Self-test B: Operation

7.3. Warnings

Warnings ("Wrnxxx" or "Warning Fxxx") are only displayed.
Unlike errors, components are not disabled.

Warning «039» must be remedied immediately, as otherwise there is a risk of electric shock.

Number	Meaning	Explanation
F007	Power failure	Operating voltage has failed
F046	Data channel interfered	Incorrect communication to the memory of the parameter values
F110	Faulty pressure gauge tube	- Incorrect pressure gauge tube - Incorrect voltage supply of the gauge tube

8. What To Do In Case Of Breakdowns?

Identifying error messages
Error messages shown on the LCD can be identified and, in part, remedied with the aid of the error code table (Chapter 7).

The last 10 errors and warnings are stored in the fault memory **[**P:360-369**]** during operation..

If the malfunction cannot be remedied:
➡ Inform PFEIFFER Service.
➡ Describe the malfunction and state the associated error messages.

9. Maintenance, Service

The unit is maintenance-free. Dirt on the front panel can simply be cleaned with a damp cloth. The unit must be disconnected from the power supply beforehand.

Please make use of our After-sales Service!
In the unlikely event of problems with your electronic drive unit, there are various ways in which you can maintain your system's availability:

– Get your unit repaired on site by PFEIFFER Service;
– Send your unit to the parent factory for repair;
– Replace the unit by an as-new replacement model.

Please contact your PFEIFFER agent for more detailed information.

The wiring diagram in Chapter 11 shows current carrying circuits and the respective operating voltages.

If you decide to undertake repairs yourself, please bear in mind that the unit may carry dangerous contact voltages.
If carrying out repairs or maintenance work yourself to units which have been in contact with substances that are hazardous to health, please observe the relevant regulations.

Please note that repair jobs on units sent in to us for repair or maintenance can only be performed in accordance with our general terms of delivery.

Contact addresses and telephone hotline:
You can find contact addresses and your telephone hotline on the back of this manual.

10. Technical Data

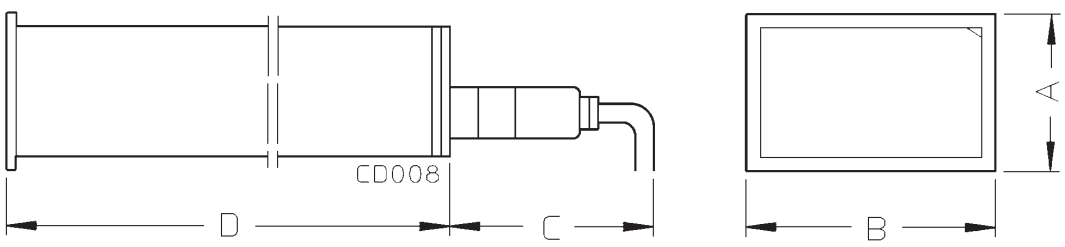
10.1. Data List For TCP 350 Electronic Drive unit

Variable	Unit	TCP 350
Connection voltage	V AC	115 (+15/-20)% 230 (+15/-20)%
Current	A	4
Rated input	VA	400
Frequency	Hz	50-60
Motor connection output voltage	V DC	72
Motor connection output current	A DC	6,5
Power loss	Watt	80
Permitted ambient temperature	°C	5 - 40
Relative humidity, max., without condensation	%	80/50[1)]
Air pressure	kPa	77-106
Installation height	m	2000
Protection category		IP 20
Safety class		I
Pollution level		2
Excess voltage class		II
Run-up time, adjustable	min	1-120
Rotation speed switch point	%	50-97
Cable length, max.	m	100
Interface		RS 485
Rotation speed setting mode, adjustable	%	20-100
Weight	kg	2,8

1) 80% at T ≤ 31° C, up to 50% at T ≤ 40° C

10.2. Dimension Diagram

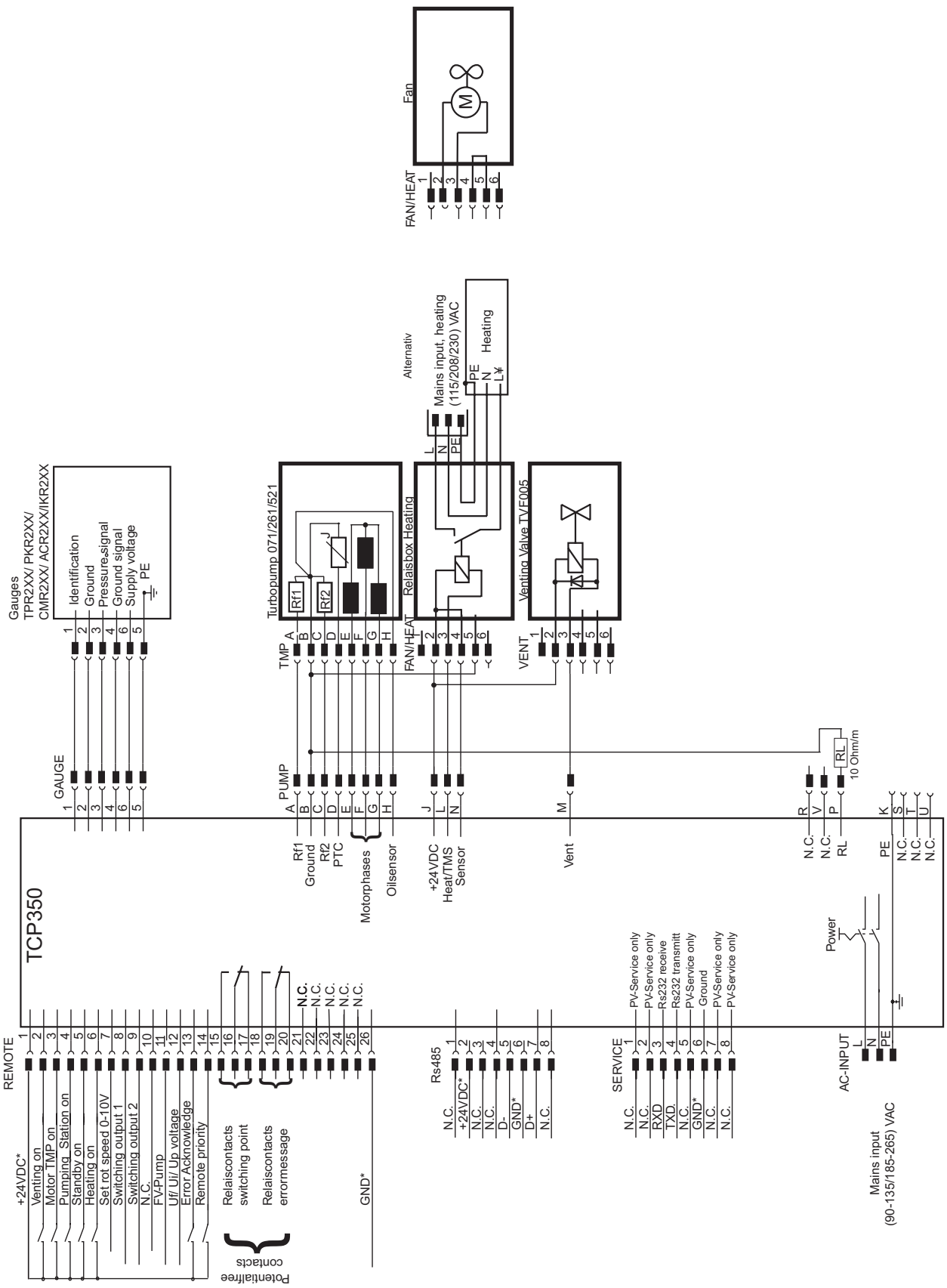
Dimension diagram of TCP 350



A	128.5 mm
B	141.9 mm
C	120 mm
D	232 mm

11. Wiring diagram

Wiring diagram of TCP 350



12. Accessories

Designation	Quantity	Number-	Remarks
Mains cable			
- Shock proof	230 V	P4564 309 ZA	
- US-Version	115 V	P4564 309 ZE	
- US-Version	208 V	P4564 309 ZF	
Pump cable	3m	PM 051 803 -T	Other lengths available on request

13. Additional Information

These Operating Instructions describe the operation of PFEIFFER turbomolecular pumps. This manual forms part of the complete operating instructions for your modular turbo pump system. You will find further instruction manuals in the scope of delivery (see table), to suit your particular combination of components.

If, despite meticulous checks by ourselves, you should be lacking information about our products, please contact your PFEIFFER dealer, or phone the hotline on the back of this manual.

All documentation is also available in PDF format.

The following operating instructions are available for our turbo pump range:

Produkt	Definition	Manual No
Turbomolecular pump	Turbomolecular pump	depends on pump type*
Turbo pump housing heater	Description of housing heater	PM 800 542 BD
Turbo pump water cooling	Description of water cooling	PM 800 546 BD
Pfeiffer Protocol RS 232/RS 485	Description of interface protocol	PM 800 488 BD
Venting valve TVF 005	Description of venting valve	PM 800 507 BD
Backing pump relay box	Description of relay box	PT 0030 BD
Turbo pump fan	Description of fan	PM 800 543 BD

*Numbers and instructions can also be obtained from PFEIFFER Service or via our Homepage at www.pfeiffer-vacuum.de.

PFEIFFER VACUUM

Konformitätserklärung
Declaration of Conformity

im Sinne folgender EU-Richtlinien:
pursuant to the following EU directives:

- **Elektromagnetische Verträglichkeit/*Electromagnetic Compatibility* 89/336/EWG**
- **Niederspannung/*Low Voltage* 73/23/EWG**

Hiermit erklären wir, daß das unten aufgeführte Produkt den Bestimmungen der EU-Richtlinie über elektromagnetische Verträglichkeit 89/336/EWG und der EU-Niederspannungsrichtlinie 73/23/EWG entspricht.

We hereby certify that the product specified below is in accordance with the provision of EU Electromagentic Compatibility Directive 89/336/EEC and EU Low Voltage Directive 73/23/EEC.

Produkt/*Product*:

TCP 350

Angewendete Richtlinien, harmonisierte Normen und angewendete, nationale Normen:

Guidelines, harmonised standards, national standards which have been applied:

EN 61010, EN 55011, EN 50081-1, EN 61000-6-2

Unterschrift/*Signature:*

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